

Measurement of CP-violating Asymmetries asymmetries in $B^0 \rightarrow \rho^\pm h^\mp$ decays

R. Aleksan, A. Gaidot, P.F. Giraud, P.F. Harrison, T.J. Harrison,
A. Hocker, H. Lacker, S. Laplace, F. Le Diberder, R Liu, H. Li,
E.O. Olaiya, Y. Pan, V. Shelkov, G. Vasseur, F. Wilson,
J. von Wimmersperg-Toeller, J. Wu, S.L. Wu, Ch. Yecho

CEA-Saclay, France

Queen Mary, University of London, UK

LAL-Orsay, France

University of Birmingham, UK

University of Bristol, UK

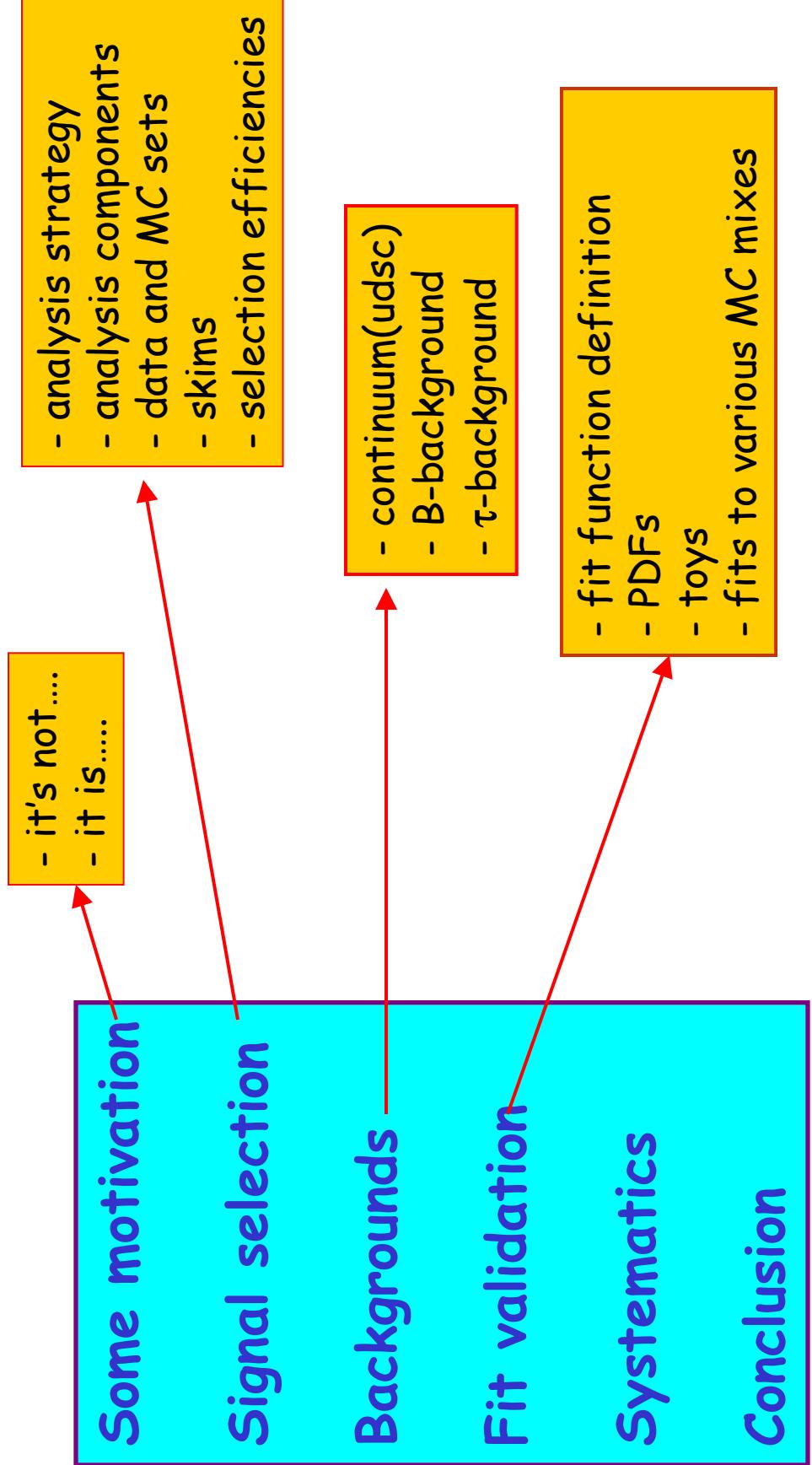
University of Wisconsin, USA

Lawrence Berkeley Lab, USA

LPNHE-Paris, France

Rutherford Appleton Laboratory, UK

Measurement of CP-violating Asymmetries asymmetries in $B^0 \rightarrow \rho^\pm h^\mp$ decays



Some motivation("it's not")

→ $\rho^+\pi^\mp$ is not a CP-eigen state, there are 4 possible combinations of B^0, \bar{B}^0 decays into $\rho^+\pi^-, \rho^-\pi^+$ final states

→ it's not a "golden mode" - in the lowest order, P(penguin) and T(tree) amplitudes have different weak phases and cannot be considered as one amplitude (e.g. $B^0 \rightarrow J/\psi K_S$). Thus, CKM "alpha" could only be extracted if:

full Dalitz plot analysis
is done (one needs to add
 $B^0 \rightarrow \rho^0\pi^0$)

theoretical input
(e.g. P is very small)

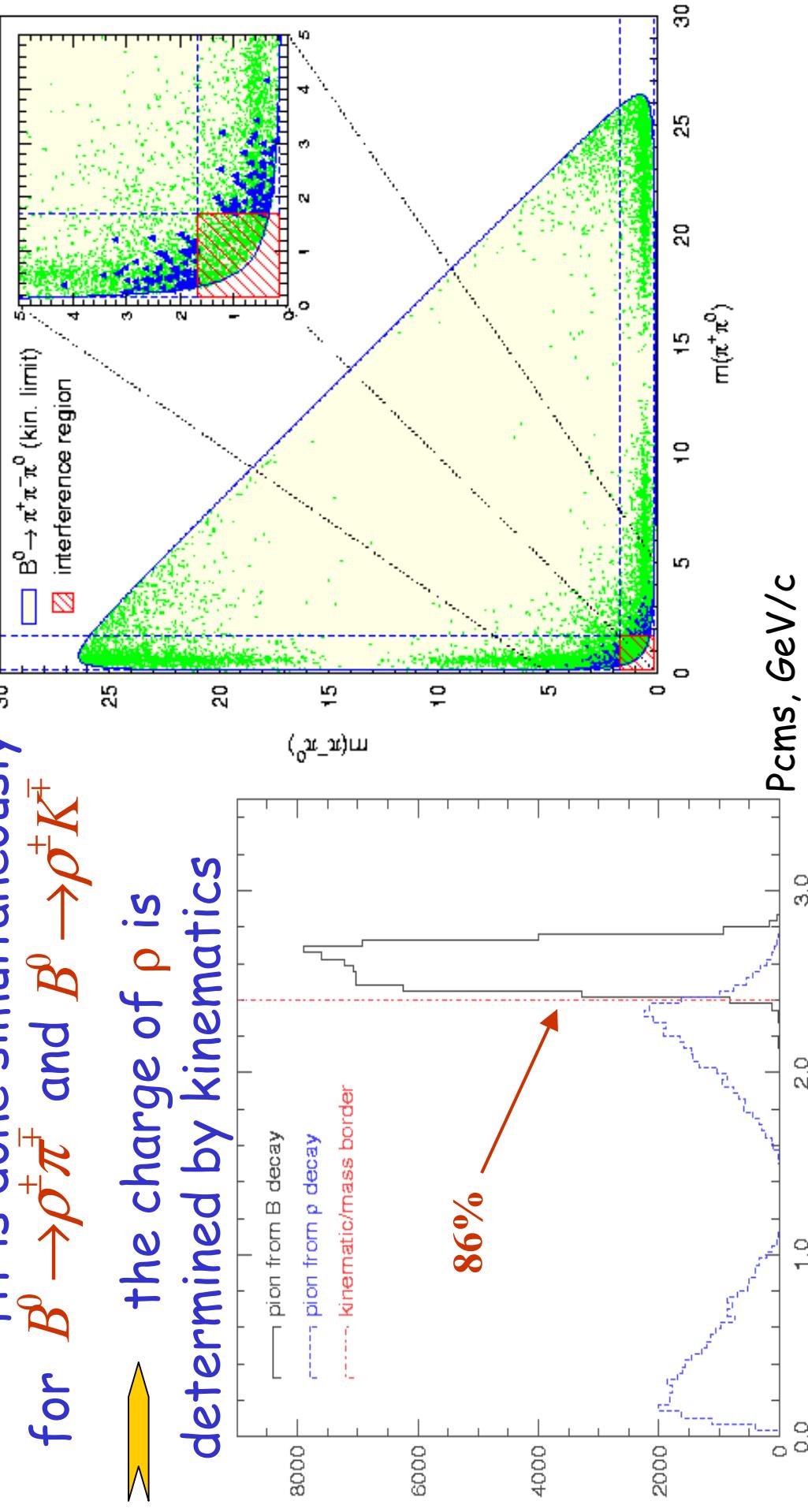
$\rho^+(770)$ is neither narrow nor
exotic - more background

Some motivation("it is")

- $B^0 \rightarrow \rho^\pm \pi^\mp$ is one of the largest branching ratios for charmless modes(expect around 450 events for 56ifb)
- relatively high interference ($\sim 20\%$) between $\rho^+ \pi^-$, $\rho^- \pi^+$, $\rho^0 \pi^0$ amplitudes - full Dalitz plot analysis possible at least in principle(the fact that $\rho^\pm(770)$ is not narrow - helps here!)
- we don't have a choice - one need to approach this decay mode sooner or later...

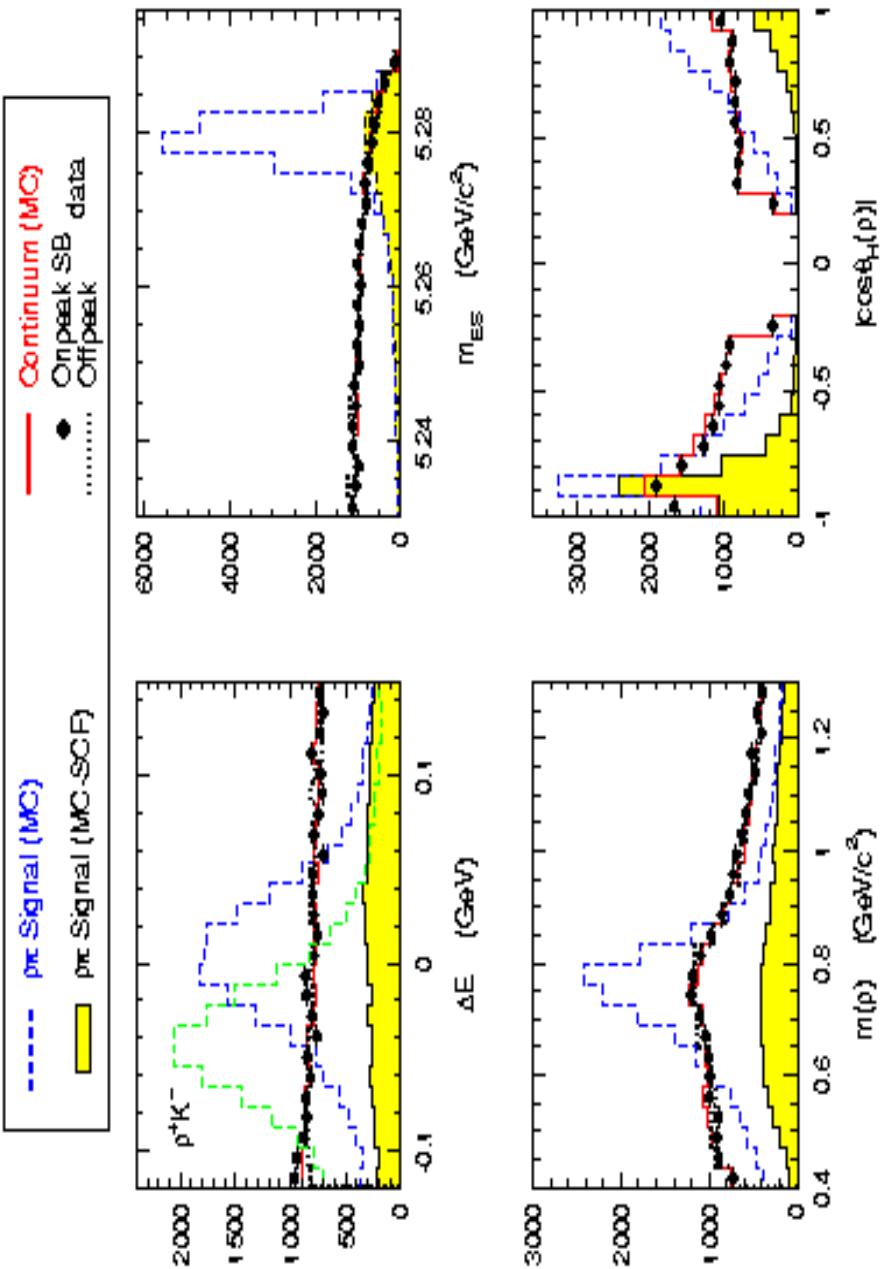
Analysis strategy

- we perform a "quasi 2-body" analysis of $B^0 \rightarrow \rho^\pm \pi^\mp$ decay, by avoiding the interference region of Dalitz plot
- fit is done simultaneously for $B^0 \rightarrow \rho^\pm \pi^\mp$ and $B^0 \rightarrow \rho^\pm K^\mp$
- the charge of ρ is determined by kinematics



Analysis strategy

- we separate signal contributions into 3 components:
 - true signal(using MC matching)
 - self-cross feed(SCF) with **right Q($\sim 30\%$)**
 - self-cross feed with **wrong Q($\sim 4\%$)**



no such
"true-vs-fake π^0 "
separation is done
for any of the
backgrounds

Analysis strategy

$B^0 \rightarrow \rho^+ \pi^-$

$$f_{B^0 tag}^{\rho^+ \pi^-} = (1 + A_{CP}^{\rho\pi}) \frac{e^{-|\Delta|/\tau}}{4\tau} \left[1 + \frac{\Delta D_{C_{tag}}}{2} + \langle D \rangle_{C_{tag}} \left(S_{\rho\pi}^+ \sin(\Delta m_d \Delta t) - C_{\rho\pi}^+ \cos(\Delta m_d \Delta t) \right) \right]$$

$\overline{B}^0 \rightarrow \rho^+ \pi^-$

$$f_{\overline{B}^0 tag}^{\rho^+ \pi^-} = (1 + A_{CP}^{\rho\pi}) \frac{e^{-|\Delta|/\tau}}{4\tau} \left[1 - \frac{\Delta D_{C_{tag}}}{2} - \langle D \rangle_{C_{tag}} \left(S_{\rho\pi}^+ \sin(\Delta m_d \Delta t) - C_{\rho\pi}^+ \cos(\Delta m_d \Delta t) \right) \right]$$

$B^0 \rightarrow \rho^- \pi^+$

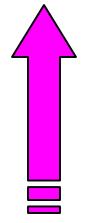
$$f_{B^0 tag}^{\rho^- \pi^+} = (1 - A_{CP}^{\rho\pi}) \frac{e^{-|\Delta|/\tau}}{4\tau} \left[1 + \frac{\Delta D_{C_{tag}}}{2} + \langle D \rangle_{C_{tag}} \left(S_{\rho\pi}^- \sin(\Delta m_d \Delta t) - C_{\rho\pi}^- \cos(\Delta m_d \Delta t) \right) \right]$$

$\overline{B}^0 \rightarrow \rho^- \pi^+$

$$f_{\overline{B}^0 tag}^{\rho^- \pi^+} = (1 - A_{CP}^{\rho\pi}) \frac{e^{-|\Delta|/\tau}}{4\tau} \left[1 - \frac{\Delta D_{C_{tag}}}{2} - \langle D \rangle_{C_{tag}} \left(S_{\rho\pi}^- \sin(\Delta m_d \Delta t) - C_{\rho\pi}^- \cos(\Delta m_d \Delta t) \right) \right]$$

if any of these three is true:

$$\left\{ \begin{array}{l} A_{CP}^{\rho\pi} \neq 0 \\ C_{\rho\pi}^+ + C_{\rho\pi}^- \neq 0 \\ S_{\rho\pi}^+ + S_{\rho\pi}^- \neq 0 \end{array} \right.$$



CP is violated

Analysis components

- signal B selection:

- skim data using `BCCPi03body` tag bit (**66%** - signal, **19%** - onpeak)
- tracks are **GoodTracksVeryLoose**
- π^0 are from **piLooseMass**: $0.11 < m(\gamma\gamma) < 0.16, \text{GeV}/c^2$
- $E_\gamma > 50 \text{ MeV}, 0.01 < \text{LAT}_\gamma < 0.6$
- $0.4 < M(p) < 1.3, \text{GeV}/c^2, \text{helicity } |H(p)| > 0.25$
- $5.23 < M_{e\gamma} < 5.2895, \text{GeV}/c^2, -0.12 < E - E_{beam} < 0.15, \text{GeV}$
- veto electron, kaon, proton for softer track
- $N_\gamma(\text{DIRC}) > 5$
- $m(\pi\pi^0) < 5.14, m(\pi^-\pi^+) < 5.14 \text{ GeV}/c^2 (\text{against 2-body B-bkg})$
- continuum discriminator cut (**30%** - **signal**, **0.1%** - **onpeak**)
- 1 combination/event with "best" $m(p0)$ is taken

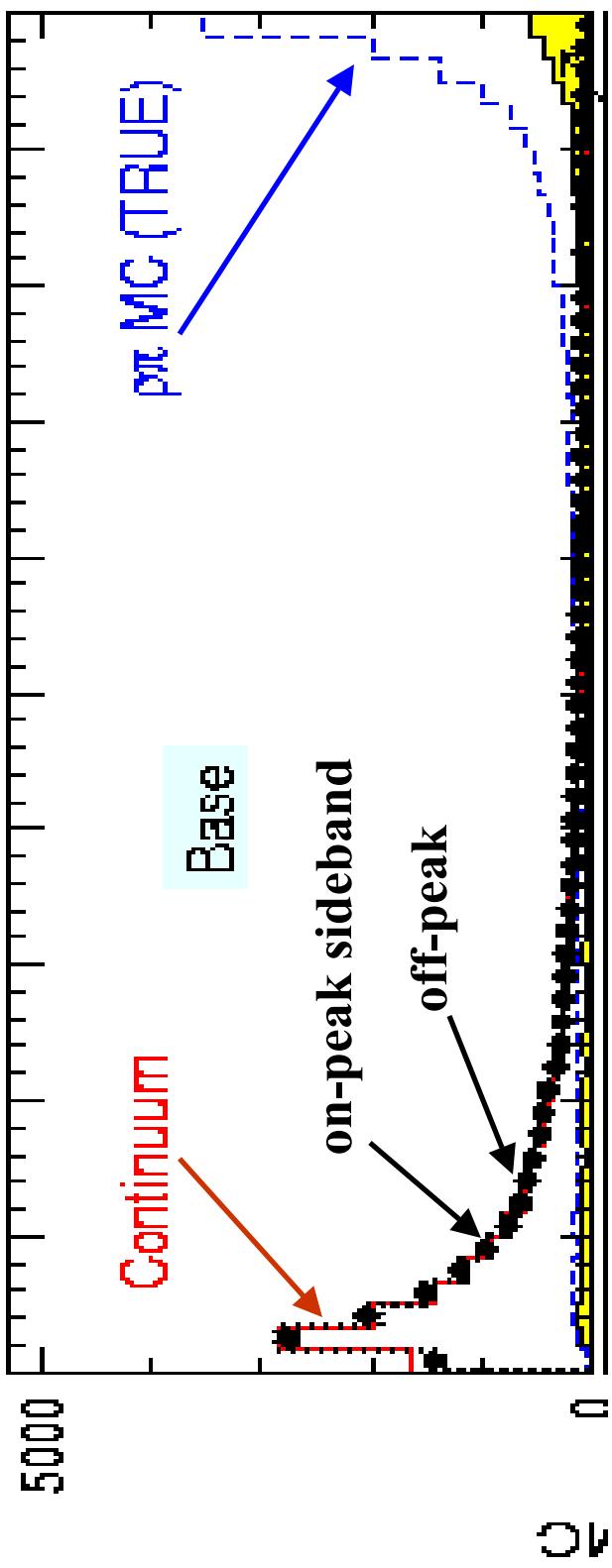
- other B selection:

- unused for signal B reconstruction:
 - tracks from **GoodTracksLoose**
 - nevtrals from **CalorNeutral**
- used to calculate various event-shape variables

Choice of MVA

- we considered a large number of event shape variables to be used for discrimination against continuum background, and decided to use the most simple one:

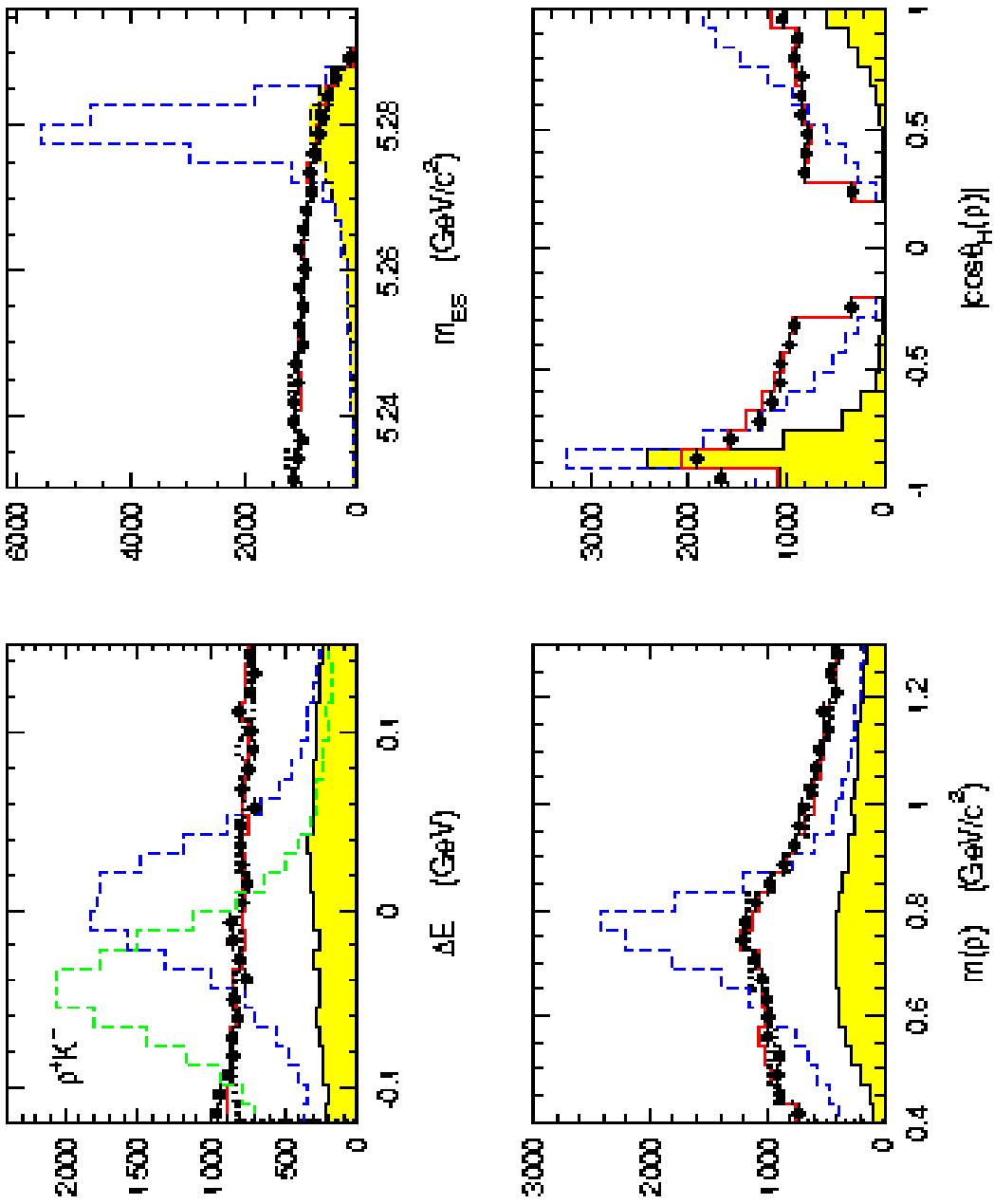
NN with 4 variables(Base): $m(\rho), \cos\theta_H(\rho), L_0, L_2$



Choice of MVA

Legend:

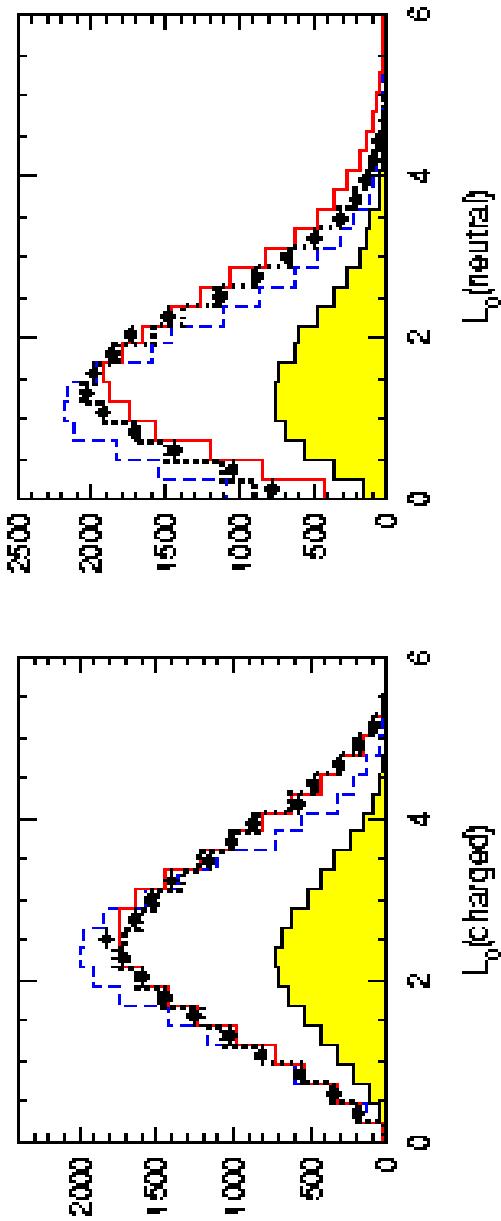
- MC Signal (MC)
- MC Signal (MC-SHF)
- Continuum (MC)
- Onpeak SB data
- Offpeak



Choice of MVA

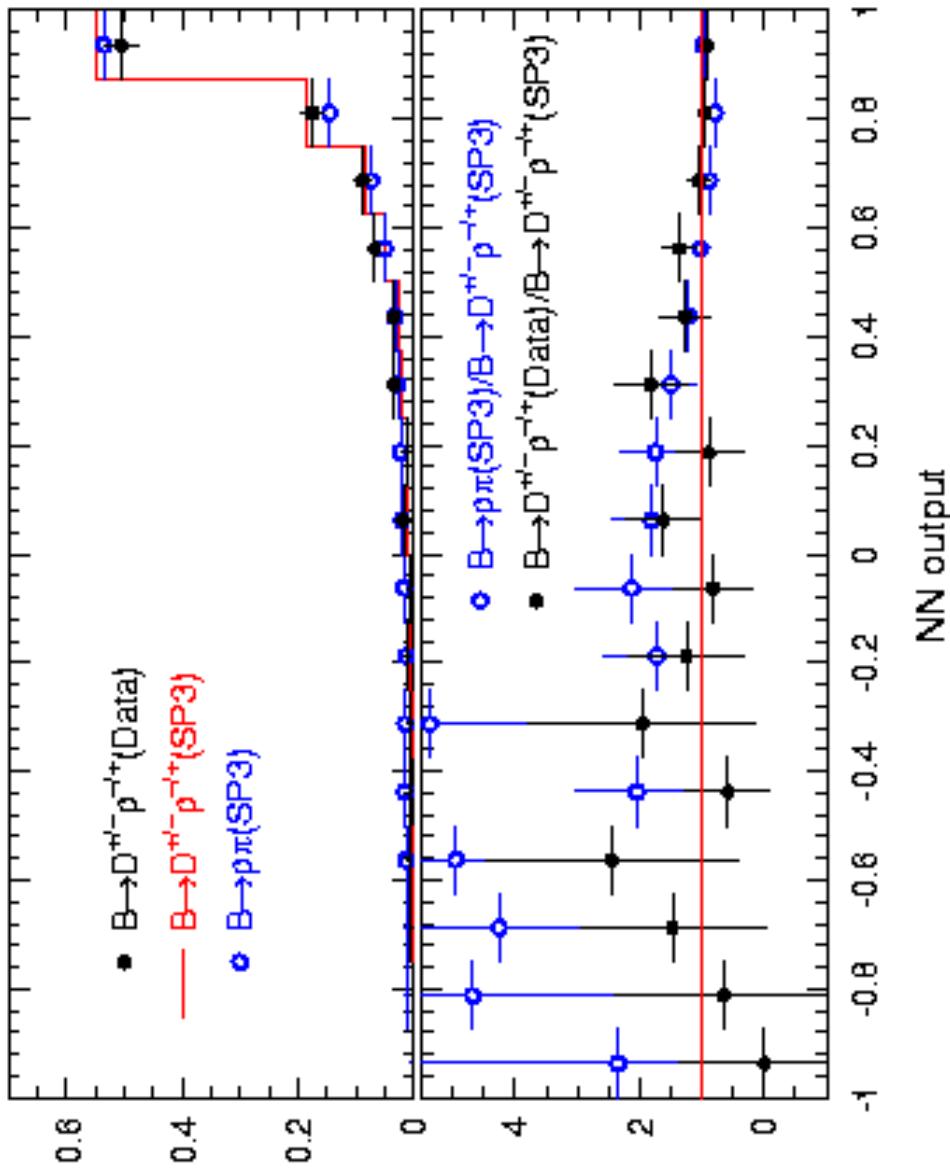
Legend:

- Continuum (MC)
- Signal (MC)
- Signal (MC-SGF)
- Onpeak SB data
- Offpeak



Validation of MVA

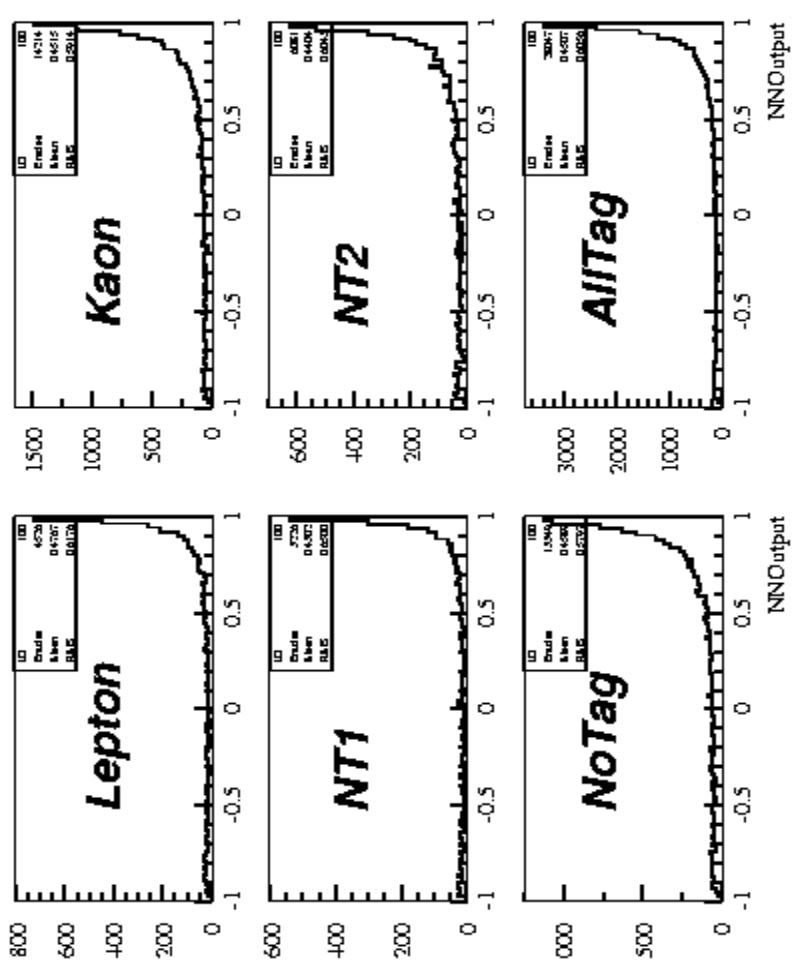
- we used fully reconstructed $B^0 \rightarrow D^\pm \rho^\mp$ events and compared NN output for Data and MC($D^\pm \rho^\mp, \rho^\pm \pi^\mp$)



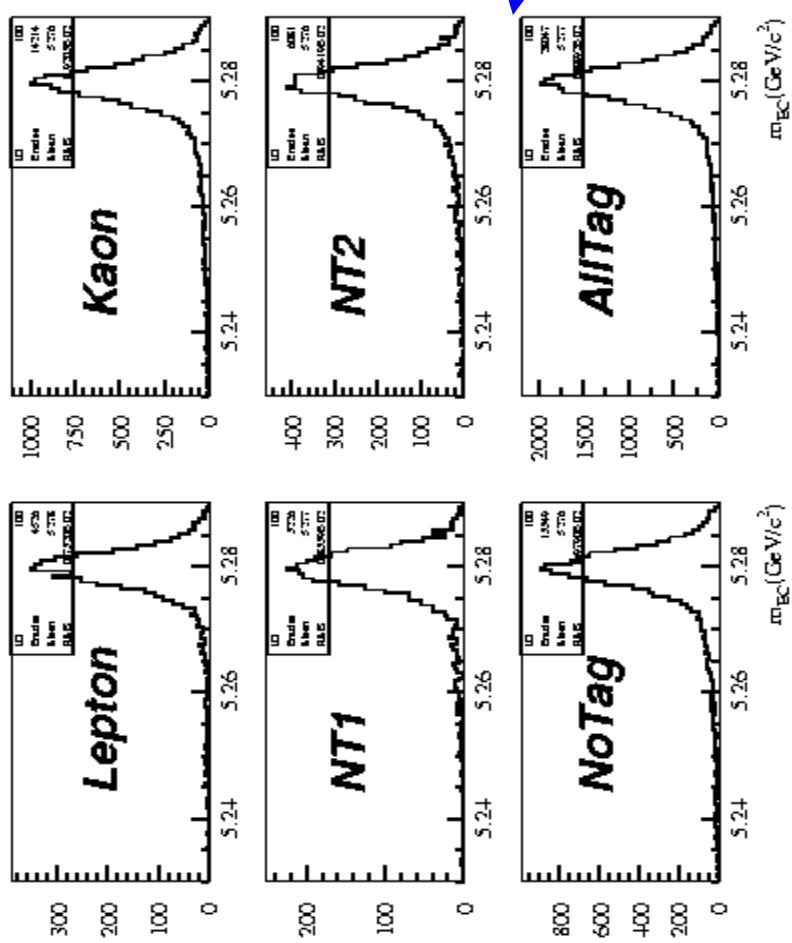
Validation of MVA

NN output for tag categories

(after discovery of this dependence, we do a tag-by-tag separation in the fit)



Mes for tag categories



Data and MC samples

- Data and Monte Carlo:

Run 1(2000): on-resonance 20.3fb^{-1} , off 2.6fb^{-1}
Run 2(2001): on-resonance 35.7fb^{-1} , off 3.8fb^{-1}
signal $B \rightarrow p\pi$ SP4 MC: 58×10^3 events(interfering and non-interfering)
signal $B \rightarrow pK$ SP4 MC: 33.0×10^3 events
generic uds SP4 MC: 31.2×10^6 events
generic ccbar SP4 MC: 8.7×10^6 events
generic B^+B^- SP4 MC: 26.2×10^6 events
generic B^0B^0 SP4 MC: 34.0×10^6 events
charmless1 SP4 MC: 1.3×10^6 events
charmless2 SP4 MC: 2.9×10^6 events
80 exclusive 2,3,4-body charmless B-decays:
 2.35×10^6 (SP4) and 0.3×10^6 (SP3)

Tau background

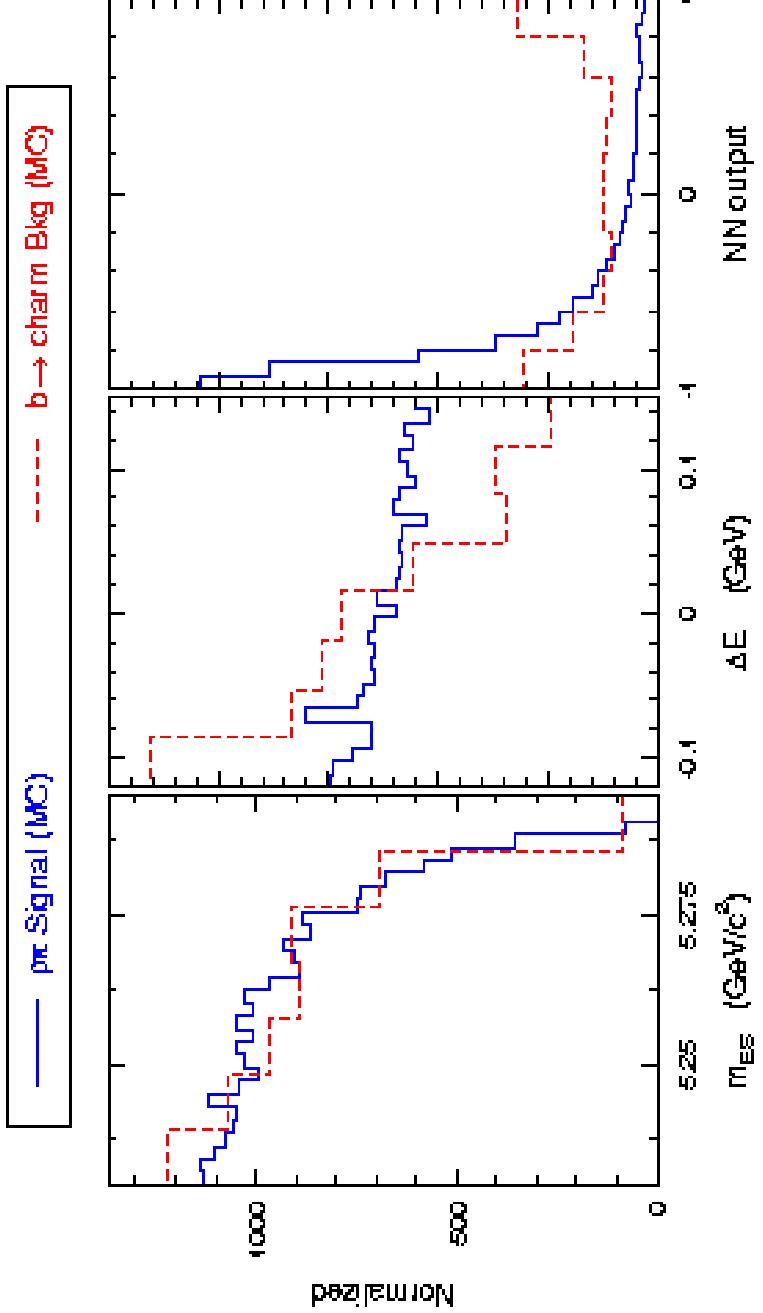
using 8.5×10^6 generic Tau MC events, after all the cuts, we found it to be 3% of the dominant **udsc** background, it's **very udsc-like** in many projections and most of it goes into un-tagged category

	Lepton	Kaon	NT1	NT2	No Tag
off-peak	$0.4+/-0.1$	$26.6+/-0.6$	$4.6+/-0.3$	$14.9+/-0.5$	$53.4+/-0.7$
tau MC	$0.5+/-0.5$	$6.6+/-1.8$	$7.1+/-1.8$	$8.6+/-2.0$	$77.3+/-3.0$

no tau-specific PDF is added to the Likelihood function,
udsc parameterization should account for it

B \rightarrow charm background

Using 34.0×10^6 $B^0\bar{B}^0$ and 26.0×10^6 B^+B^- of generic MC events, we found that after all cuts there will be **1.6%**(compared to udsc) contamination.

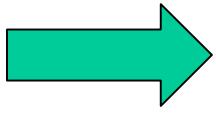


no specific $b \rightarrow c$ PDF is added to the Likelihood function,
udsc parameterization should account for it

Charmless B- background

started with **80** 2,3,4-body **charmless modes** from SP4 MC

all selection cuts are applied,
 $N(\text{expected}) > 1$ event is required



end up with **21** 2,3,4-body **charmless modes**

the biggest contributions are taken exclusively, others are grouped together according to their CP properties



11 PDFs are added to the Likelihood function

Charmless B- background

#	Mode	BR (10^{-6})	Haf.	ϵ (%)	N_{exp}	CP
4-body						
1	$B^0 \rightarrow K^{*+}(K_S^0 \pi^+) \pi^-$	8.7 ± 3.0	[23]	0.6	3.4	I
2	$B^0 \rightarrow K^{*+}(K^+\pi^0) \rho^-$	$10 \pm 10^*$		0.9	5.8	I
3	$B^+ \rightarrow K^{*0}(K^+\pi^-) \rho^+$	$35 \pm 15^*$		0.1	3.9	I
4	$B^0 \rightarrow \rho^+ \rho^-$ long.	$70 \pm 30^*$		3.0	89.5	NST
5	$B^0 \rightarrow \rho^0 \rho^0$ long.	1.5 ± 1.5	?	1.1	1.1	I
6	$B^+ \rightarrow \rho^+ \rho^0$ long.	$15 \pm 5^*$		1.6	15.4	I
7	$B^0 \rightarrow \eta(\rho^0 \gamma) K^{*0} (K^+\pi^-)$	$30 \pm 10^*$		0.05	0.98	I
8	$B^+ \rightarrow \eta(\rho^0 \gamma) K^+$	33.13 ± 3.1	?	0.6	8.3	I
9	$B^+ \rightarrow \eta(\rho^0 \gamma) \pi^+$	$8 \pm 3^*$		0.9	1.7	I
10	$B^0 \rightarrow \eta(\rho^0 \gamma) \pi^0$	$5 \pm 5^*$		0.3	1.0	I
11	$B^0 \rightarrow \omega_1^+(\rho^0 \pi^+) \pi^-$	$38 \pm 10^*$		0.5	11.1	NST
3-body						
12	$B^0 \rightarrow K^{*+}(K^+\pi^0) \pi^-$	8.7 ± 3.0	[23]	5.6	31.1	ST
13	$B^0 \rightarrow K^{*0}(K^+\pi^0) \pi^0$	$3. \pm 3.0^*$		3.1	5.9	ST
14	$B^+ \rightarrow \rho^+ \pi^0$	$15 \pm 8^*$		3.0	18.3	I
15	$B^+ \rightarrow \rho^0 K^+$	8.4 ± 4.0	?	4.6	24.2	I
16	$B^+ \rightarrow \rho^0 \pi^+$	13.8 ± 3.6	?	5.8	47.1	I
17	$B^+ \rightarrow K_S^0 \pi^+$	8.7 ± 1.3	?	1.6	8.6	CB
18	$B^+ \rightarrow K^+ f_0(\pi^+\pi^-)$	11.7 ± 4.0	[24]	3.3	16.1	I
2-body						
19	$B^0 \rightarrow K^+ \pi^-$	$18.5 \pm 1.$	WA Moriond	0.03	3.85	ST
20	$B^+ \rightarrow K^+ \pi^0$	11.6 ± 1.5	WA Moriond	1.5	10.85	CB
21	$B^+ \rightarrow \pi^+ \pi^0$	5.9 ± 1.4	WA Moriond	1.1	4.1	CB

the largest
contributor!



“inclusive”

“non
self-tagging”

“self-tagging”

“charged”

Charmless B-background

- Charged B decays(e.g. $B^+ \rightarrow \rho^0 \pi^+$):

$$P(\Delta t, \text{tag} = \pm, \text{charge} = \pm) = \mathcal{W}_{\text{tag, charge}} e^{-|\Delta t|/\tau}$$

$$\mathcal{W}_{\text{tag, charge}} = \{B^0 \rho^+; B^0 \rho^-; \bar{B}^0 \rho^+; \bar{B}^0 \rho^-; \text{NoTag}\}$$

- Neutral self-tagging(e.g. $B^0 \rightarrow K^{*+} \pi^-$):

$$f_{B^0 \text{tag}}^{K^{*+} \pi^-} = \frac{e^{-|\Delta t|/\tau}}{4\tau} \left[1 + \frac{\Delta D}{2} + \langle D \rangle \cos(\Delta m_d \Delta t) \right] W_{\text{charge}}$$

$$f_{B^0 \text{tag}}^{K^{*-} \pi^+} = \frac{e^{-|\Delta t|/\tau}}{4\tau} \left[1 + \frac{\Delta D}{2} - \langle D \rangle \cos(\Delta m_d \Delta t) \right] W_{\text{charge}}$$

- Neutral non-self-tagging(e.g. $B^0 \rightarrow \rho^+ \rho^-$):

$$f_{B^0 \text{tag}}^{\pm} = \frac{e^{-|\Delta t|/\tau}}{4\tau} \left[1 + \left(S_{\text{eff}}^{\pm} \sin(\Delta m_d \Delta t) - C_{\text{eff}}^{\pm} \cos(\Delta m_d \Delta t) \right) \right]$$

$$f_{B^0 \text{tag}}^{\mp} = \frac{e^{-|\Delta t|/\tau}}{4\tau} \left[1 + \left(S_{\text{eff}}^{\mp} \sin(\Delta m_d \Delta t) - C_{\text{eff}}^{\mp} \cos(\Delta m_d \Delta t) \right) \right]$$

- mis-charge and mis-tag
Rates are absorbed into $S_{\text{eff}}^{\pm}, C_{\text{eff}}^{\pm}$

- for CP-eigen states,
 $S_{\text{eff}}^+ = S_{\text{eff}}^-, C_{\text{eff}}^+ = C_{\text{eff}}^-$

Charmless B- background

$$1) B^+ \rightarrow K_S^0 \pi^+$$

$$f(K) = 0.0, n_{\text{expected}} = 8.6$$

$$2) B^+ \rightarrow \rho^0 K^+, B^+ \rightarrow K^+ f_0 \quad f(K) = 0.92, n_{\text{expected}} = 40.3$$

$$3) B^+ \rightarrow K^+ \pi^0, B^+ \rightarrow \pi^+ \pi^- \quad f(K) = 0.73, n_{\text{expected}} = 17.5$$

$$4) B^+ \rightarrow \rho^+ \pi^0, B^+ \rightarrow \rho^0 \pi^+ \quad f(K) = 0.0, n_{\text{expected}} = 65$$

$$5) B^+, 4\text{-body(inclusive)} \quad f(K) = 0.42, n_{\text{expected}} = 38$$

Self-Tagging

$$6) B^0 \rightarrow K^+ \pi^- \quad f(K) = 0.59, \omega_Q^K = 0.4, \omega_Q^\pi = 0.0, n_{\text{expected}} = 3$$

$$7) B^0 \rightarrow K^{*+} (K^+ \pi^0) \pi^- \quad f(K) = 0.40, \omega_Q^K = 0.6, \omega_Q^\pi = 0.0, n_{\text{expected}} = 31$$

$$8) B^0 \rightarrow K^{*0} (K^+ \pi^-) \pi^- \quad f(K) = 1.0, \omega_Q^K = 0.0, \omega_Q^\pi = 0.0, n_{\text{expected}} = 6$$

Non Self-Tagging

$$9) B^0 \rightarrow a_1^+ \pi^-$$

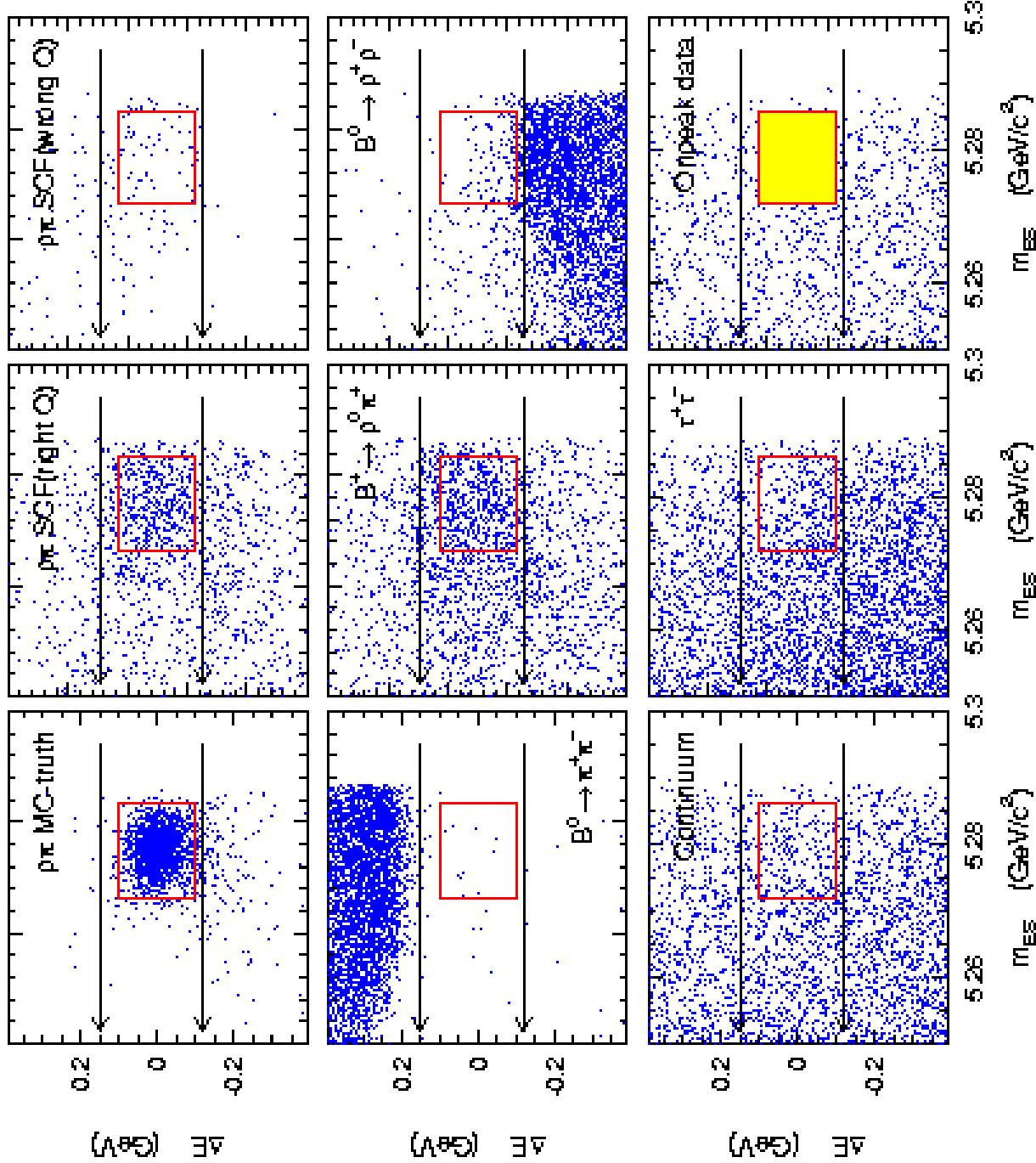
$$C^+ = -0.36, C^- = 0.02, n_{\text{expected}} = 11$$

$$10) B^0 \rightarrow \rho^+ \rho^-$$

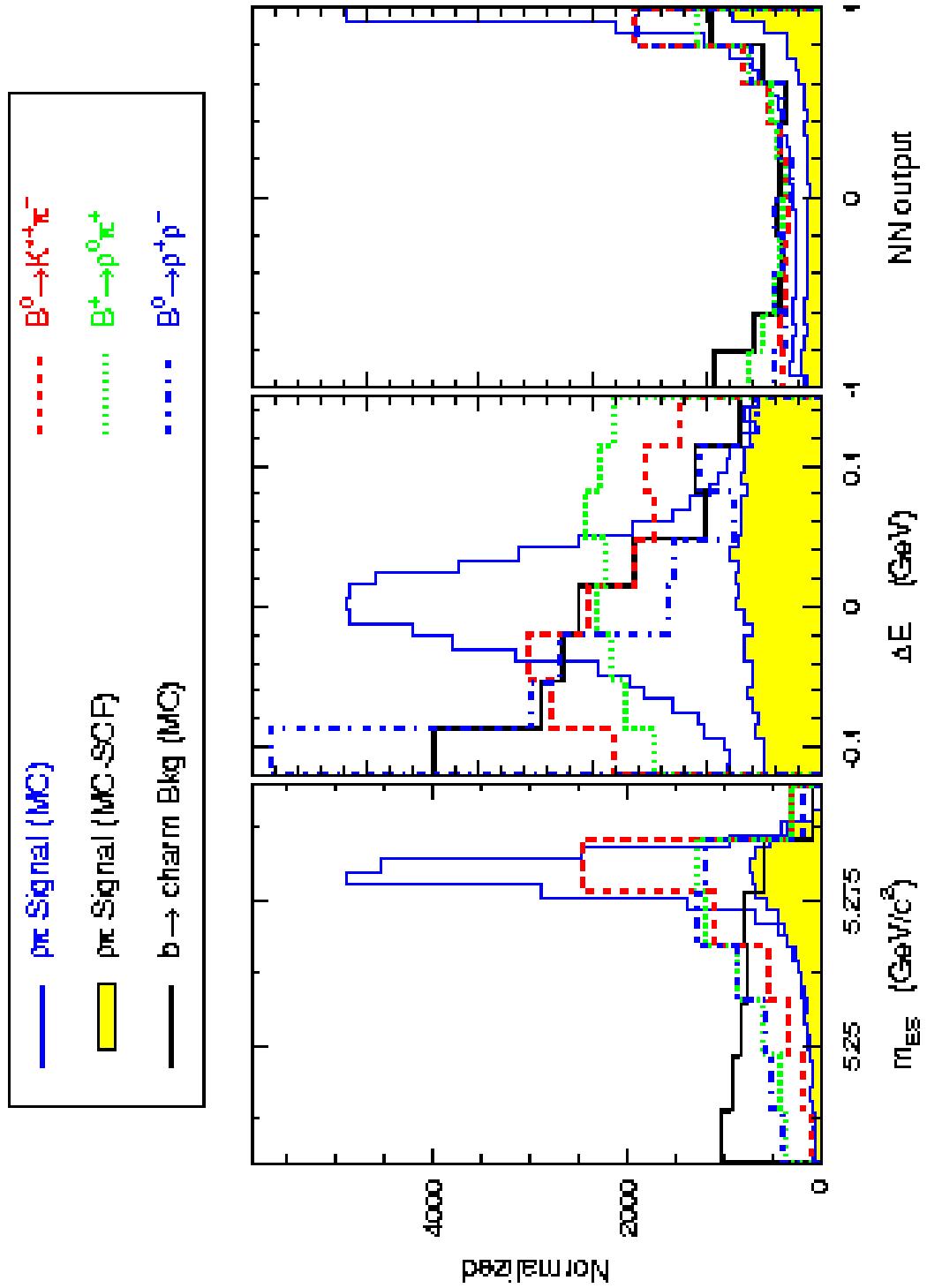
$$C^+ = -0.13, C^- = 0.11, n_{\text{expected}} = 90$$

$$11) B^0, 4\text{-body}(inclusive) \quad C^+ = 0.0, C^- = 0.0, n_{\text{expected}} = 20$$

Data selection

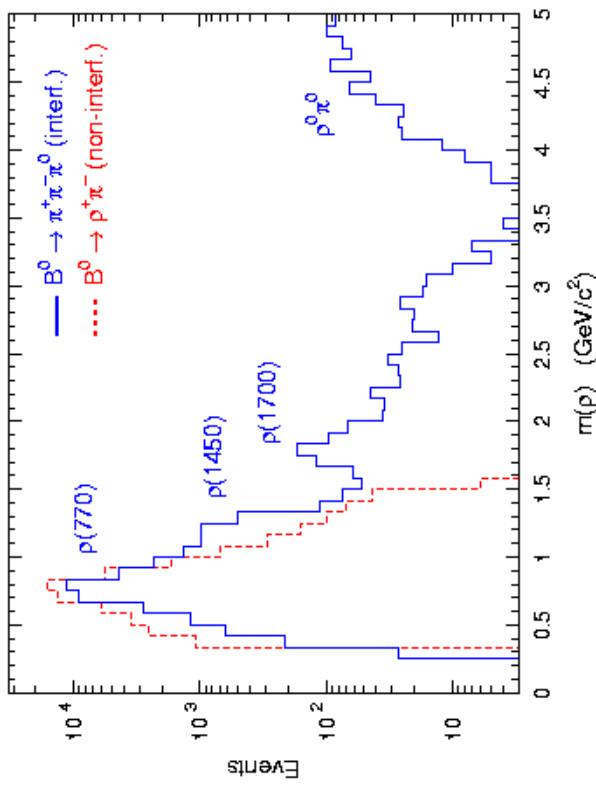


Data selection



Data selection

Cut description	$\epsilon_{\rho\pi}^{\text{MC}}$ [%]	$\epsilon_{\rho\pi}^{\text{MC}} \cdot \mathcal{R}$ [%]	$\epsilon_{\rho\pi}^{\text{MC}}$	$\epsilon_{\rho\pi}^{\text{Data}}$	$\epsilon_{\rho\pi}^{\text{Data}} \cdot \mathcal{R}$ [%]	$\epsilon_{\rho\pi}^{\text{MC}}$	$\epsilon_{\rho\pi}^{\text{Data}}$	$\epsilon_{\rho\pi}^{\text{Data}} \cdot \mathcal{R}$ [%]	$\epsilon_{\rho\pi}^{\text{MC}}$	$\epsilon_{\rho\pi}^{\text{Data}}$	$\epsilon_{\rho\pi}^{\text{Data}} \cdot \mathcal{R}$ [%]
Double tag regions	99	99	99	69	69	69	70	67	67	67	68
$ \cos\theta_{\pi^0}(\rho) > 0.25$	91	91	91	56	56	56	57	53	53	54	56
Photon quality	87	87	87	48	48	48	47	45	45	46	47
$0.11 < m(\gamma\gamma) < 0.16 \text{ GeV}/c^2$	88	88	88	46	46	46	47	45	45	46	47
$5.33 < m_{\text{res}} < 5.3895 \text{ GeV}/c^2$	82	82	82	24	24	24	25	23	23	27	27
$-0.13 < \Delta E < 0.15 \text{ GeV}$	68	68	68	7	7	7	6	6	6	7	7
$ \Delta T < 30 \text{ ps}$	70	70	70	6	6	6	7	6	6	7	7
$\sigma(\Delta T) < 2.5 \text{ ps}$	70	70	70	6	6	6	7	6	6	7	7
$m(\pi^+\pi^-) < 5.14 \text{ GeV}/c^2$	67	67	67	6	6	6	7	6	6	7	7
electrobo veto	67	67	67	6	6	6	6	6	6	6	6
$n_{\text{EMC}}^{\text{Data}} > 5$	67	67	67	5	5	5	5	5	5	5	5
isobc veto	57	57	57	33	33	33	34	34	34	34	34
protobo veto	56	56	56	33	33	33	34	34	34	34	34
$m(\pi^+\pi^0) < 5.11 \text{ GeV}/c^2$	56	56	56	33	33	33	34	34	34	34	34
NN > 0.0	45	45	45	12	12	12	0.6	0.6	0.6	0.6	0.3



final efficiencies:

$$\mathcal{E}_{\rho\pi}^{\text{non-interf}} = 29.9\%, f_{SCF} = 30.5\%, \omega_Q = 13.6\%$$

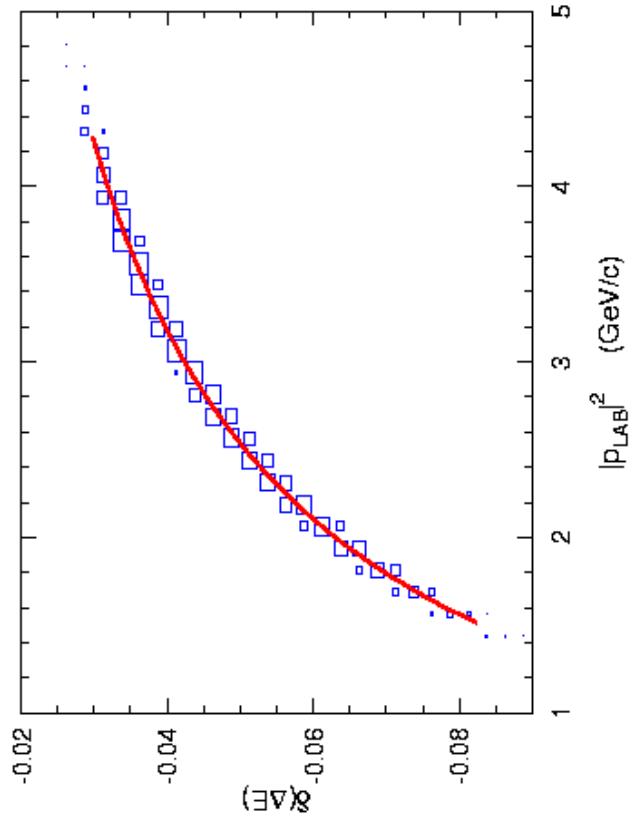
$$\mathcal{E}_{\rho\pi}^{\text{interf}} = 28.3\%, f_{SCF} = 30.7\%$$

$$\mathcal{E}_{\rho K} = 27.5\%, f_{SCF} = 28.1\%, \omega_Q = 5.1\%$$

Likelihood Function

- to extract CP parameters of $B^0 \rightarrow \rho^\pm \pi^\mp, B^0 \rightarrow \rho^\mp K^\pm$ decays we create a Likelihood Function:

$$L = F(M_{\text{ES}}, \Delta E, x_{\text{NN}}, \theta_{\text{cherenkov}}, \Delta t)$$



- we take into account $P(\text{lab})$ -dependent shift in ΔE when $\rho^\mp K^\pm$ is reconstructed, and assume π mass everywhere

- for $\theta_{\text{cherenkov}}$, Carlo's momentum and angle-dependent parameterization is taken

Likelihood Function

$$P_{i,C} = \frac{N_{p\pi} f_C^{p\pi} (1 + Q_p A_{CP}^{p\pi}) P_{i,C}^{pK} + N_{pK} f_C^{pK} (1 + Q_p A_{CP}^{pK}) P_{i,C}^{pK}}{N_{qp\pi} f_C^{qp\pi} (1 + Q_p A_{CP}^{qp\pi}) P_{i,C}^{qp\pi} + N_{qpK} f_C^{qpK} (1 + Q_p A_{CP}^{qpK}) P_{i,C}^{qpK}}$$

$$+ N_{Bp\pi}^C (1 + Q_p A_{CP}^{Bp\pi}) P_{i,C}^{Bp\pi} + N_{BpK}^C (1 + Q_p A_{CP}^{BpK}) P_{i,C}^{BpK} + \Xi_C^{p\pi} + \Xi_C^{pK}$$

where:

N_{px} - fitted number of signal events of px type

f_C^{px} - fitted number of signal events of type px that are tagged in category C

N_{qpx}^C, N_{Bpx}^C - number of continuum background events with b. track x , tagged C

Q_p - charge of p

$A_{CP}^{px} = (N_{\rho^+ x^-} - N_{\rho^- x^+}) / (N_{\rho^+ x^-} - N_{\rho^- x^+})$ - time/charge integrated, direct CP

$P_C^{px} = P_C^{px}(m_{ES}) \cdot P_C^{px}(\Delta E, P_{batch}) \cdot P_C^{px}(xNN) \cdot P_C^{px}(\theta_C, P_{batch}, \theta) \cdot P_C^{px}(\Delta t)$

$\Xi_C^{p\pi}, \Xi_C^{pK}$ - exclusive B-background channels where the bachelor track is true π or K

Tagging and vertexing

- **tagging**: we use Elba tagger to determine flavor of the tag-side B
- tagging efficiencies and mistag rates are taken from fully reconstructed B-events(Breco and Bcp)

- **vertexing**: the distance Δz between B - vertices are determined by BaBar's standard **VtxTagBtaSelFit** class

B – signal standard “**triple gaussian model**” is used, biases and scale factors ar taken from B-reco

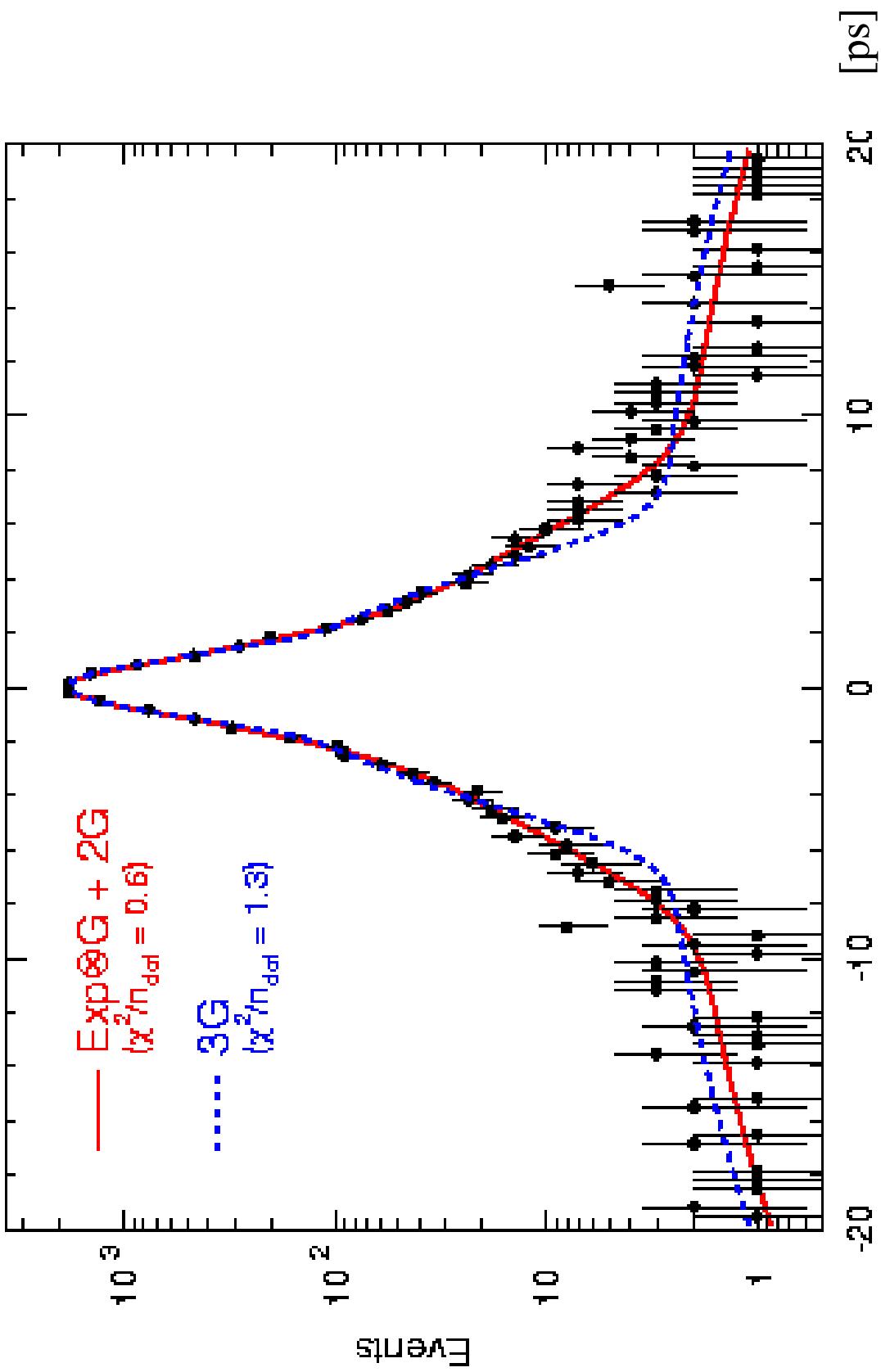
Continuum

modified Gaussian with convoluted exponential decay distribution(taken from $B \rightarrow h+h-$ analysis)

B – background

for modes with possible CP content, the resolution function is the same as for B-signal, charged Bs – lifetime function

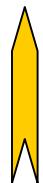
Tagging and vertexing



Distribution and fits to the Δt for onpeak sideband

Fit Validation

when all the components are "on", fit becomes quite complicated, we anticipate around 35-40 parameters (depending on whether we fit ΔE and Mes params.) - **accurate validation is essential** various toy experiments, which explore wide parameter-space of variables we are trying to fit - **checks internal fit biases**

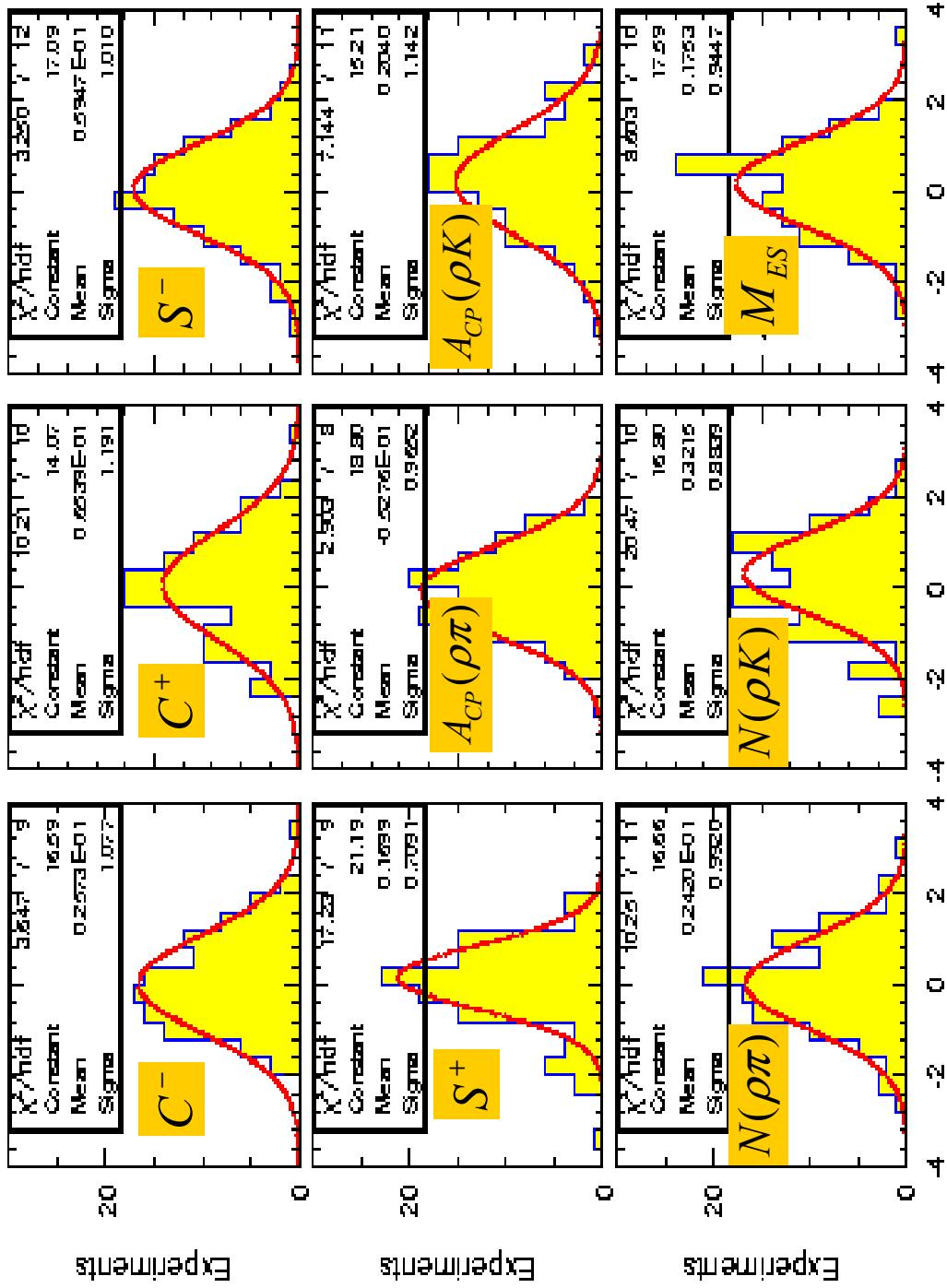


fits to pure and mixed MC samples to
- **checks PDFs, correlations, scale factors**

need to cross check that we can fit consistent B-meson parameters(mixing, lifetime)

Toys

119 toy experiments with 39 parameters generated with expected number of signal, continuum, and all B-background modes revealed no obvious biases (more statistics is needed!)



MC experiments



we used 4 different samples of signal Monte Carlo:

significant bias in $S^-(-0.147+/-0.045)$

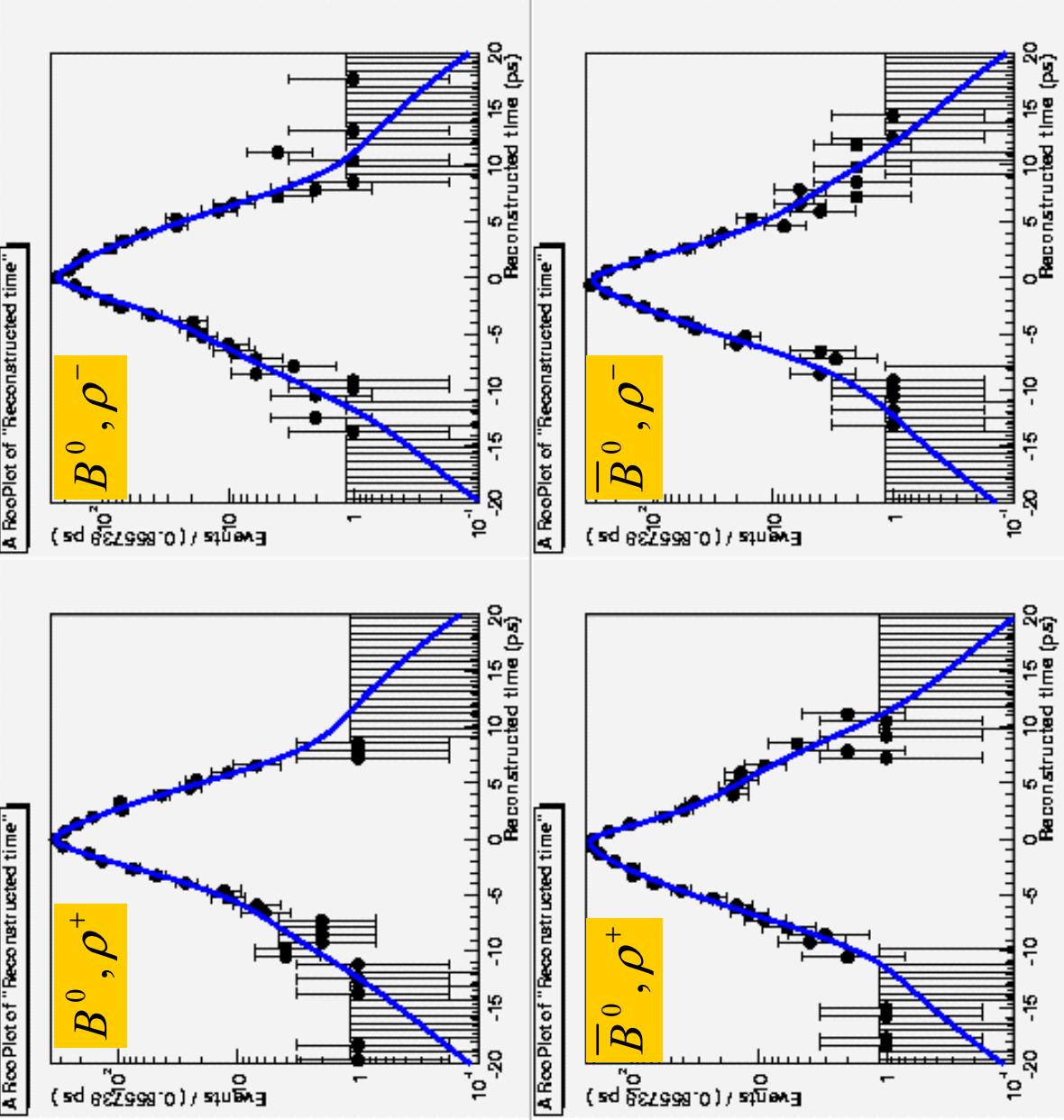
- 1) $B^0 \rightarrow \rho^-\pi^+$ (no interference effects, $C=S=0$, SP4)
OK!
- 2) $\bar{B}^0 \rightarrow \rho^+\pi^-$ (no interference effects, $C=S=0$, SP4)
OK!
- 3) $B^0, \bar{B}^0 \rightarrow \pi^+\pi^-\pi^0$ (full ρ -vs- ρ interference,
 $C^+=-0.36, C^-=0.36, S^+=0.7, S^-=0.7$, SP4)
OK!
- 4) $B^0, \bar{B}^0 \rightarrow \rho^\pm K^\mp$ ($C^-=C^+=+1$, SP4)
OK!

MC experiments

fit to the combined
sample of pure

$$B^0 \rightarrow \rho^\pm \pi^\mp, B^0 \rightarrow \rho^\mp K^\pm$$

MC events



Systematics

- is not yet complete, but many issues are covered
(e.g. we found that variation of Br by $+/-\sigma$ of unknown B-bkg branching ratios and their CP parameters can only lead to about $\sim 10\%$ bias on the value of CP parameter S (10% relative to statistical error on this parameter))
- complete assessment requires un-blinding

Conclusion

we are expecting new MC samples by Thursday and will try to figure the source of the bias, if this is solved we probably have a chance to ask for un-blinding

there are some other unresolved issues, but we are trying hard to make it to FPCP